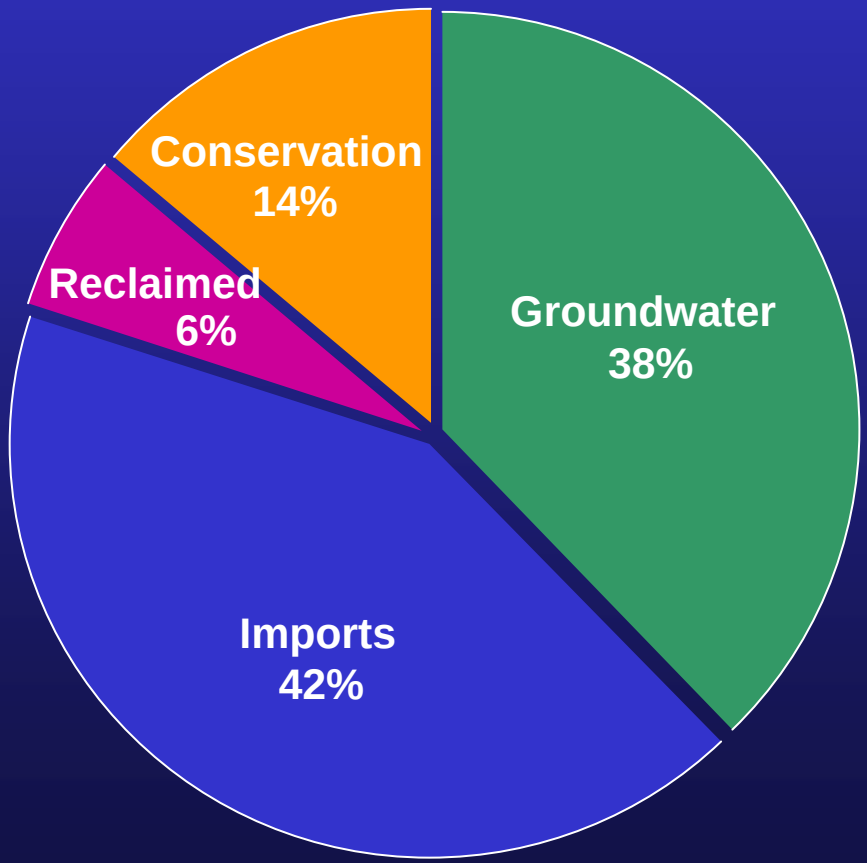
Urban Water Institute Conference
Seawater Desalination and Power

Long Beach Seawater Desalination

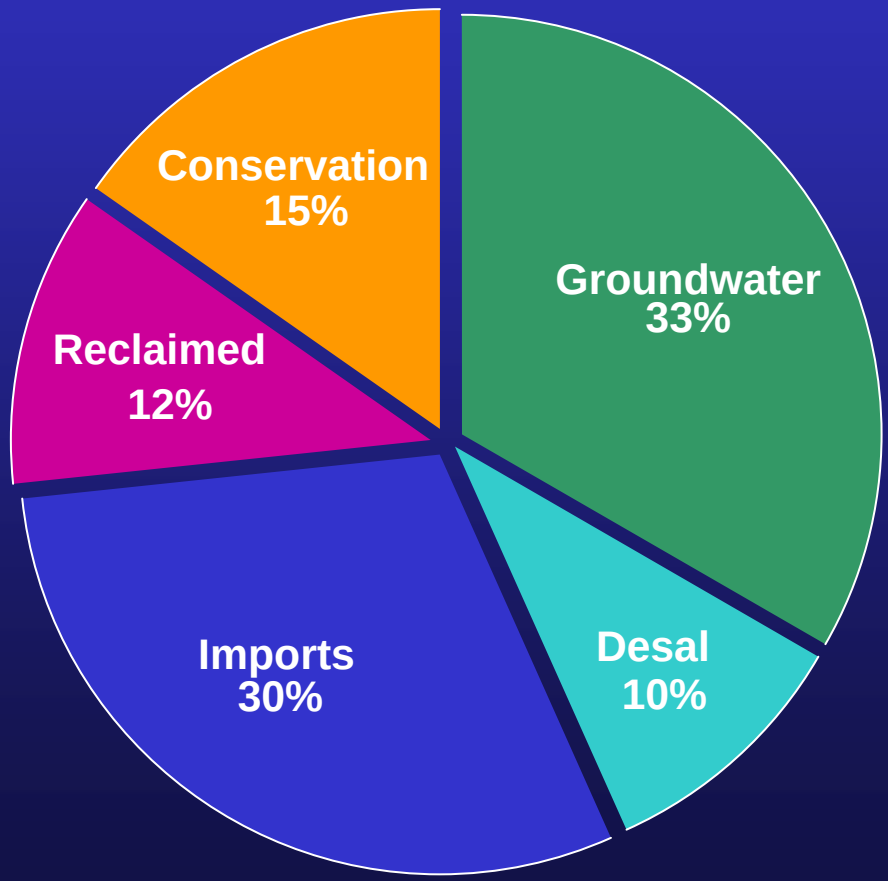
Presented by
Kevin L. Wattier, General Manage
June 23, 2005

LBWD's Resource Mix

2005



2012



LBWD's Phased Approach

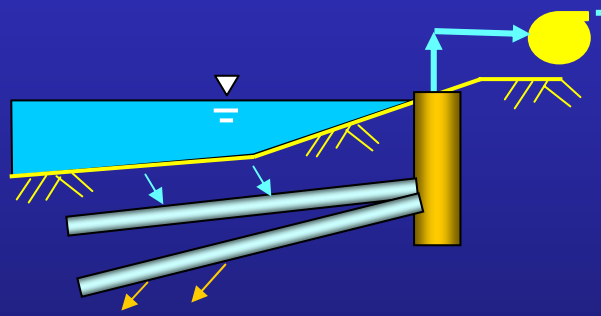
① Pilot Testing **(2001, on-going)**
- **AWWARF**

② Prototype **(2004 - 2010)**
- **USBR**
- **LADWP**

③ Production Plant (~2012)

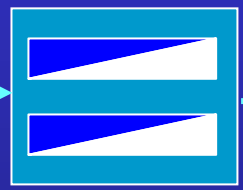
Long Beach Research Initiatives

Pretreatment



Upcoming
- Under Ocean Floor Intake and Discharge

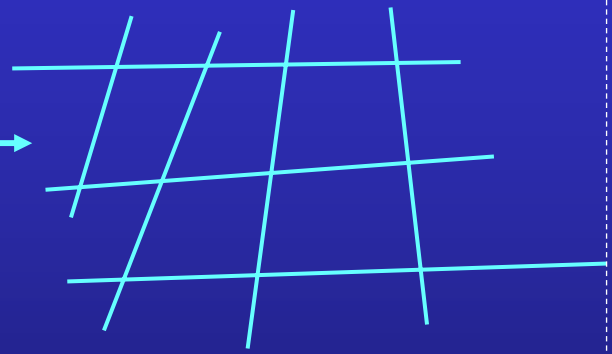
NF^2



- Boron Removal
- AwwaRF Project
  - NF^2 Verification
  - Predictive Model

Upcoming
- Prototype Research
  - Energy Recovery
  - Process Optimization
- ClO_2 / UV

Post treatment / Distribution



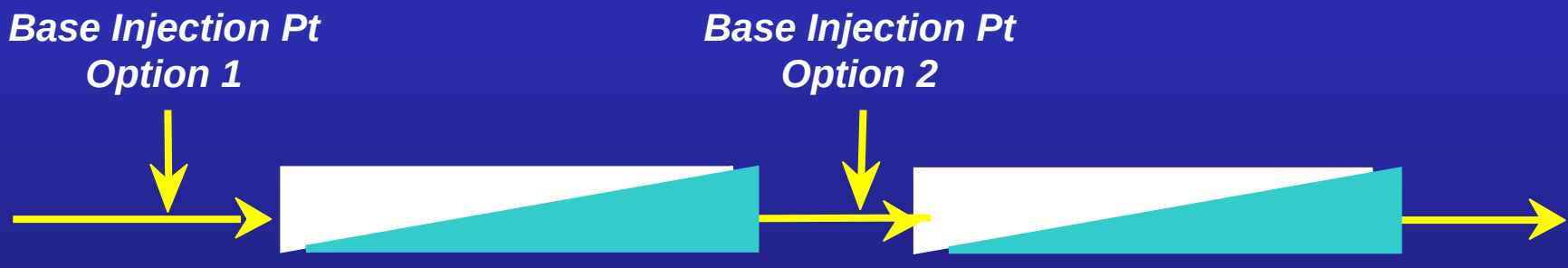
Ongoing
- Disinfectant Issues

Boron Removal Background

- Naturally occurring in seawater (~4.5 mg/L)
- Show reproductive health effect in animals
- Toxic to some common trees
- Typically < 1 mg/L in surface waters
- CDHS established Action Level at 1 mg/L
- WHO guideline at 0.5 mg/L

Boron Removal Strategy

- Selecting appropriate base addition location is critical.



$\overline{Alk}$ = 122 mg/L

$\overline{Ca^{2+}}$ = 447 mg/L

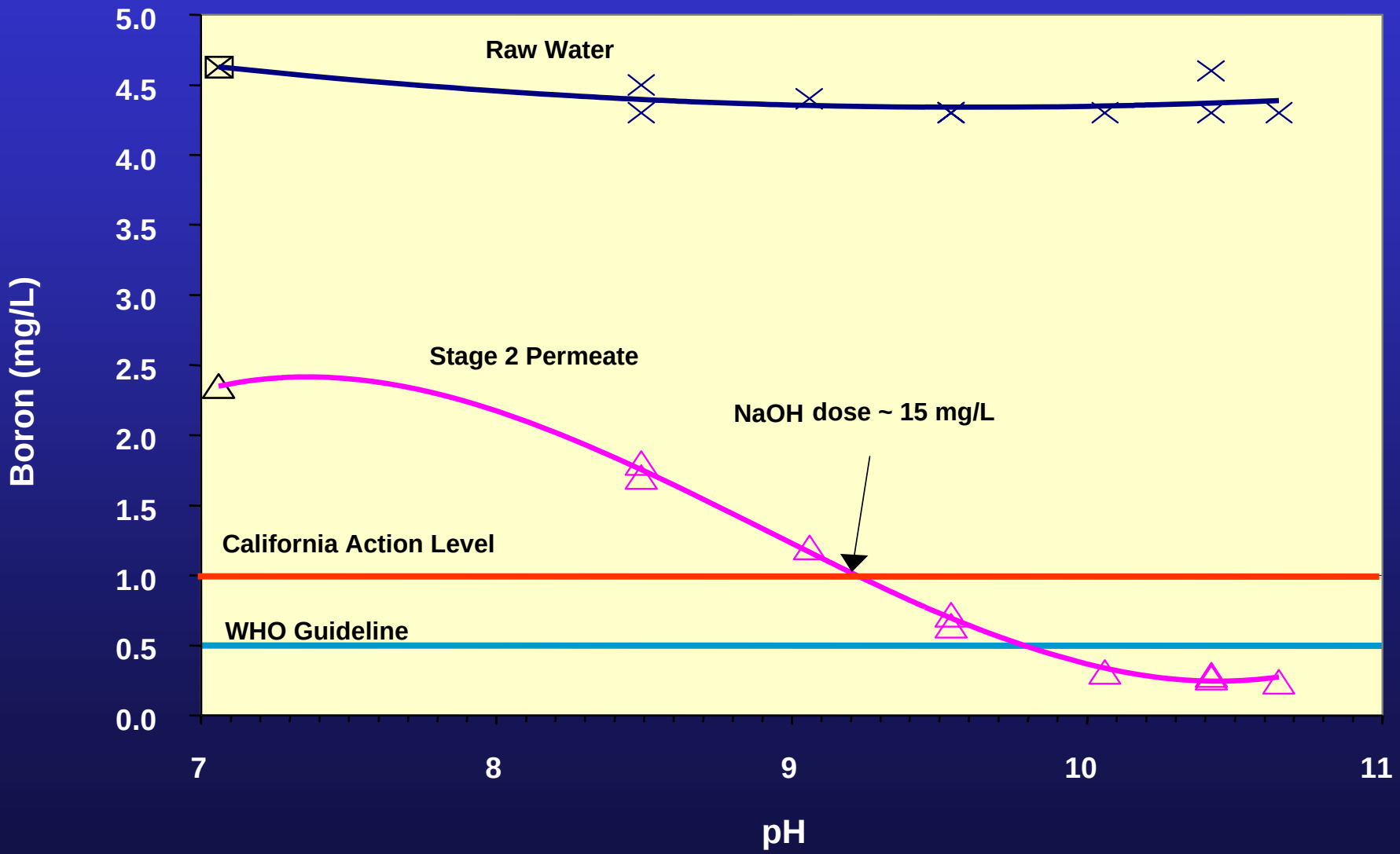
- More base required to alter pH
- HIGH potential for fouling

$\overline{Alk}$ = 10.4 mg/L

$\overline{Ca^{2+}}$ = 11.7 mg/L

- Less base required to alter pH
- 97% rejection of Ca^{2+}. Decreased potential for fouling

Boron Removal Results



AwwaRF Project Objectives

- Peer-reviewed verification/optimization of dual-pass NF process
- Membrane performance
  - Bench-scale testing
- Process optimization
  - Pilot-scale testing
  - Predictive model
- Blending strategies
  - Mitigation of DBP formation and corrosivity

AwwaRF Project Conclusions

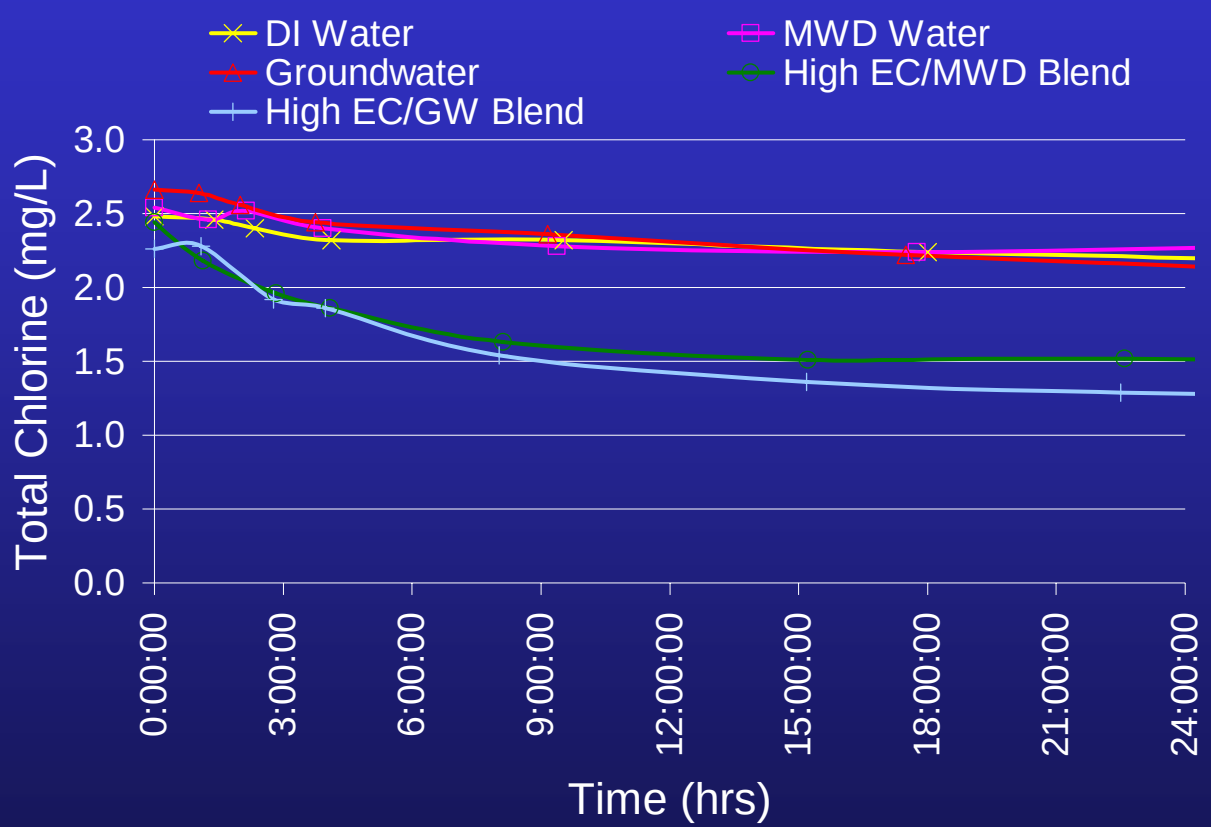
- Generated computer model to predict NF membrane performance with seawater
- Selected suitable membranes for prototype-scale testing based on water quality and energy considerations

$$\frac{\text{kWh}}{1{,}000\ \text{gal}} = \left(\frac{0.7457}{1714}\right)\left(\frac{1}{60\ \frac{Q_{2P}}{1000}}\right)\left[\frac{Q_{1F}P_{1F} + Q_{2F}P_{2F}}{75\%} - 80\%\,Q_{1C}P_{1C} - Q_{2C}P_{2C}\right]$$

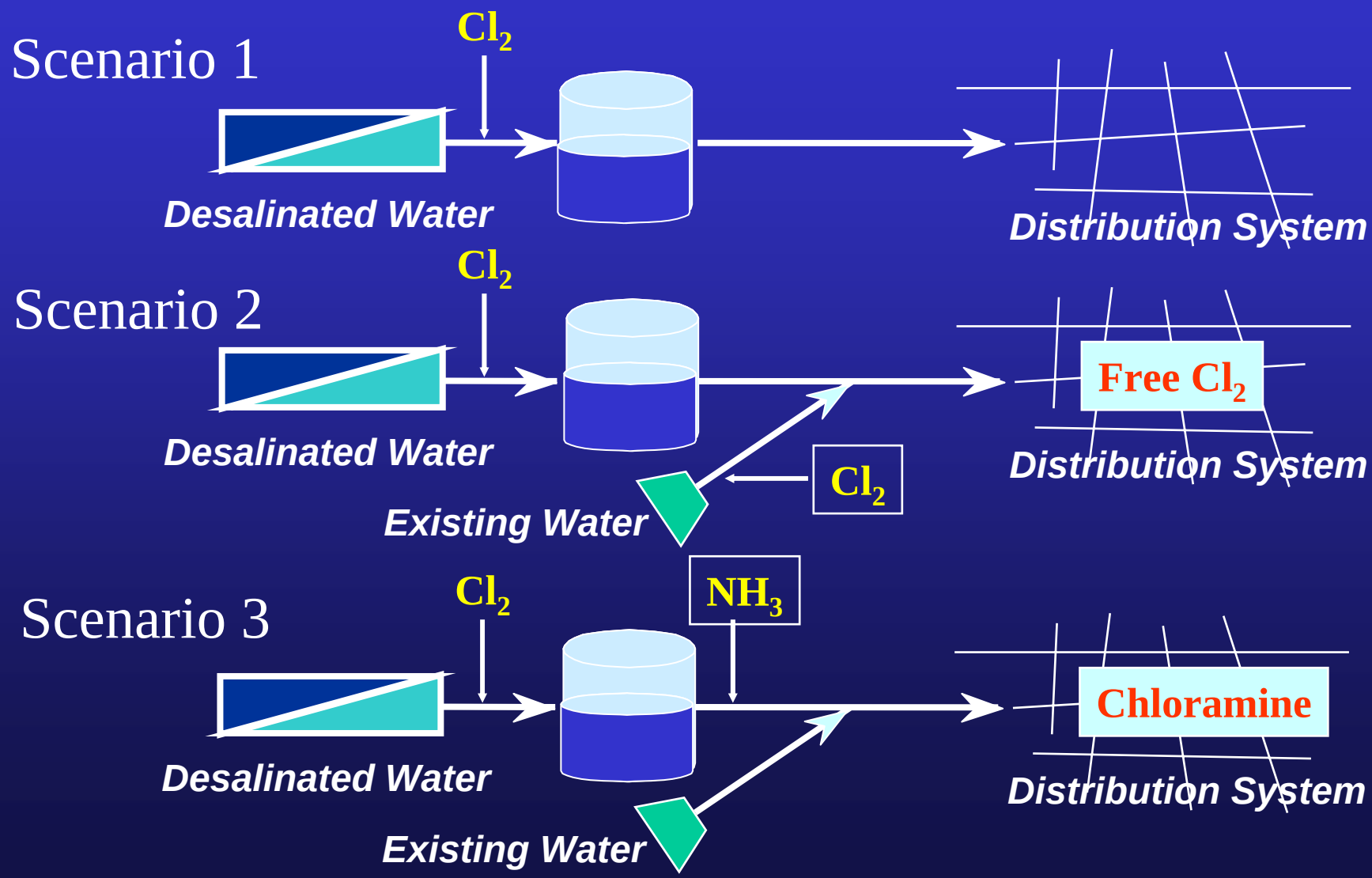
- Obtained corrosion and DBP impacts blending desalinated seawater and existing supplies

Disinfection Issues Problem Definition

- Initially, want to evaluate SDS DBP formation
- Observed rapid decay of residual disinfectant
- Isolated bromide as the cause



Disinfection Issues Blending Scenarios



***Disinfection Issues* Summary**

- Bromide is the cause for residual instability
- Need to establish a low Bromide standard
- TTHMs should not be a problem, but need to consider blend ratios and existing system water quality
- Additional work is currently underway to devise a comprehensive strategy to control residual instability

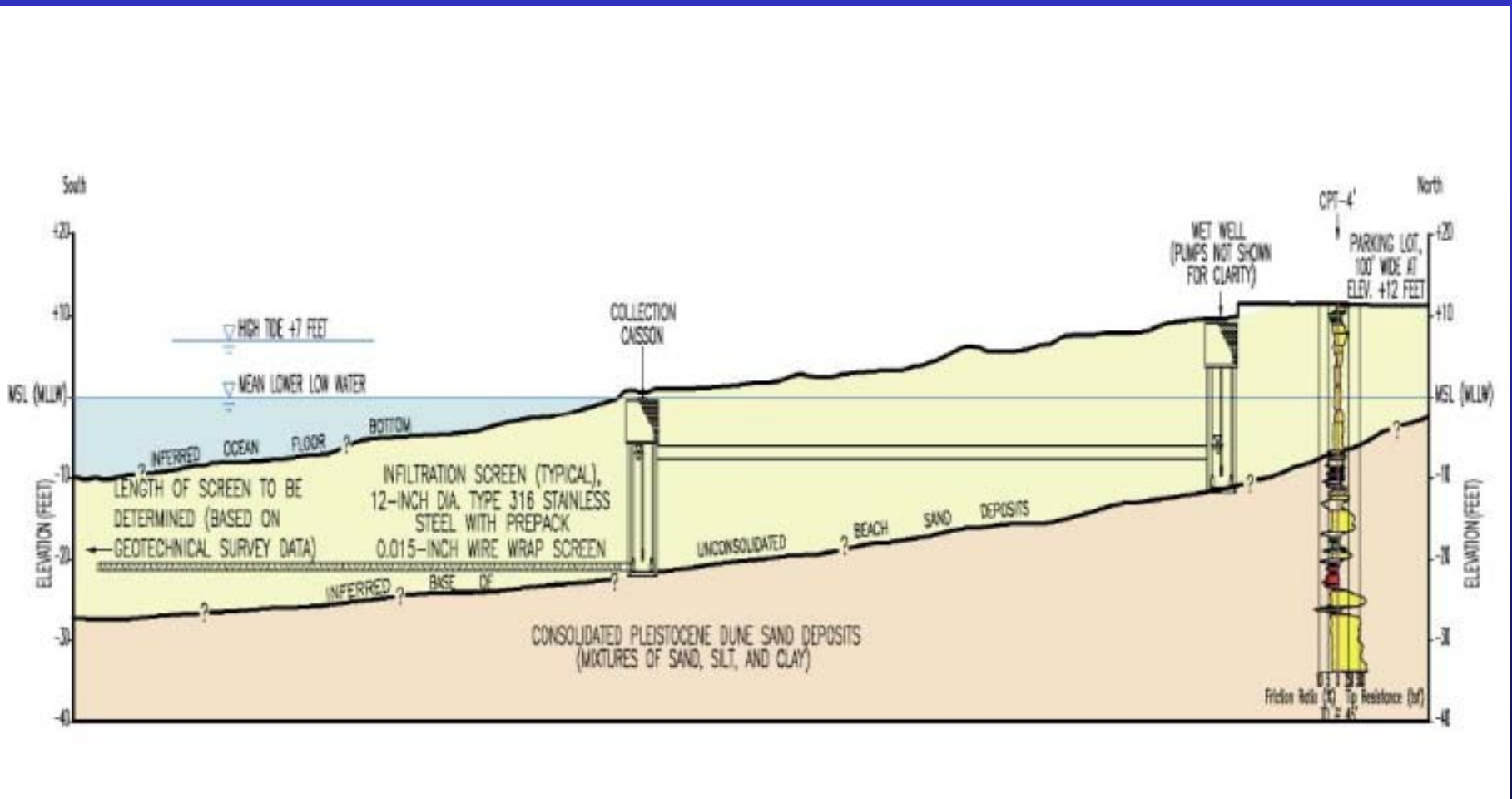
Upcoming Studies Prototype Research

- Energy Recovery
- Process Optimization
- Begin in 2005 and complete in 2007

Upcoming Studies Under Ocean Floor Intake and Discharge

- Seawater Intake
- Pretreatment
- Brine Disposal
- Prop 50 Funded
- Begin in 2006 and complete in 2009

Upcoming Studies Under Ocean Floor Intake and Discharge



Upcoming Studies ClO_2 / UV

- Key Objectives
  - Primary Disinfection
  - Minimize bio-fouling/increase membrane life
  - Oxidation of emerging contaminant (toxins)
- Prop 50 Funded
- Begin in 2006 and complete in 2009

Additional Information

- Project Staff
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  - Dr. Robert Cheng, P.E.
  - Tai Tseng, P.E.
  - Eric Leung, P.E.

- Website: www.lbwater.org